



ASSESSMENT OF THE POTENTIAL TO RE-OPEN GREAT SLAVE LAKE CLOSURE ZONES A AND B

Context

Inconnu are classified as bycatch in the Great Slave Lake (GSL) commercial Lake Whitefish fishery because there is no directed quota for them. However they are sold to the local fish processing plant. The Buffalo River Inconnu stock was depleted in the 1970s and has not fully recovered. Inconnu spawn in the Buffalo River or its tributaries in the fall and then migrate back to GSL. Fisheries and Oceans Canada (DFO) has prohibited commercial fishing for all species in several areas along the south shore of GSL to protect the Buffalo River Inconnu stock. Zone A is closed year-round, while Zone B (encompassing the Buffalo River) is closed April 1 through September 30, annually.

The Great Slave Lake Advisory Committee (GSLAC) was established by the Minister of Fisheries and Oceans to provide advice and recommendations regarding the fisheries of Great Slave Lake. The committee reports to DFO and is comprised of members of the three First Nations and the Métis group on the lake. It also has members from the commercial fishing sector, sport fishing, as well as lodges and outfitters. In 2013, GSLAC made a recommendation to DFO that Zones A and B be re-opened from September 1 - October 31, annually, to allow for the targeted inshore harvest of Lake Whitefish. DFO Resource Management has requested advice from Science by May 12, 2014 on whether or not the closure zones can be safely opened in the fall to allow for a Lake Whitefish fishery with minimal impacts to the Buffalo River Inconnu stock.

A review of all available information showed that while Inconnu harvests decrease in September and October in Area 1E of GSL (compared to summer catches), it is still possible to catch Inconnu near, and likely in, Zones A and B. If the closure areas were opened in September and October, some spawning individuals might still be caught and there is the potential to harvest the post-spawning out-migration of Inconnu from the Buffalo River which occurs in a concerted run in October. The exact dates of the out-migration vary annually and it is possible to capture large numbers of Inconnu in a short amount of time. In 2013, the total harvest of Inconnu in Area 1E alone was over double the recommended maximum removal for the entire west basin. As a result of these factors, Zones A and B should remain closed, as failure to restrict fishing in these areas could result in a high risk to Buffalo River Inconnu sustainability.

This Science Response Report results from the Science Response Process of May 1, 2014 on the Assessment of the Potential to Re-Open Great Slave Lake Closure Zones A and B.

Background

Inconnu are captured in the Great Slave Lake (GSL) Lake Whitefish commercial fishery. There is no, and never has been, directed quota for Inconnu but they can be sold to the local fish processing plant. Data suggest that large numbers of Inconnu were harvested from the Buffalo River stock in the late 1970s, after which the stock declined and has not recovered (VanGerwen-Toyne et al. 2013). From 1991 through 2010, the effort in the GSL commercial Lake Whitefish fishery declined with the closure of three of the four fish processing plants in the area (VanGerwen-Toyne et al. 2013). However, commercial fishing effort is currently on the rise again and the number of commercial licenses issued by DFO has increased (unpublished data).

Further, the remaining fish processing plant at Hay River recently extended its operational season, the price paid for Inconnu has increased substantially, and a Lake Whitefish fall roe fishery has begun (unpublished data).

In 1983, DFO designated a three kilometer radius around the mouth of the Buffalo River as closed to all commercial fishing to protect the Inconnu stock (Figure 1). Since then, additional areas along the south shore of the west basin of GSL have also been closed temporally to all commercial fishing. In June 2008, Zones A and B were established in Area 1E (Figure 1). Zone A was closed all year and Zone B was closed June 18 through September 30 (when the fish processing plant closed), annually (VanGerwen-Toyne et al. 2013). In 2009, all closure zones were revised to start April 1. Additionally, in 2013 the Zone B closure was extended to March 31 (all year, (Appendix 1) in recognition of the fish processing plant extending its operational season (from summer only to all year). Zone B is currently scheduled to re-open October 1, 2014. The Hay River Domestic Zone is closed permanently to all commercial fishing (Figure 1).

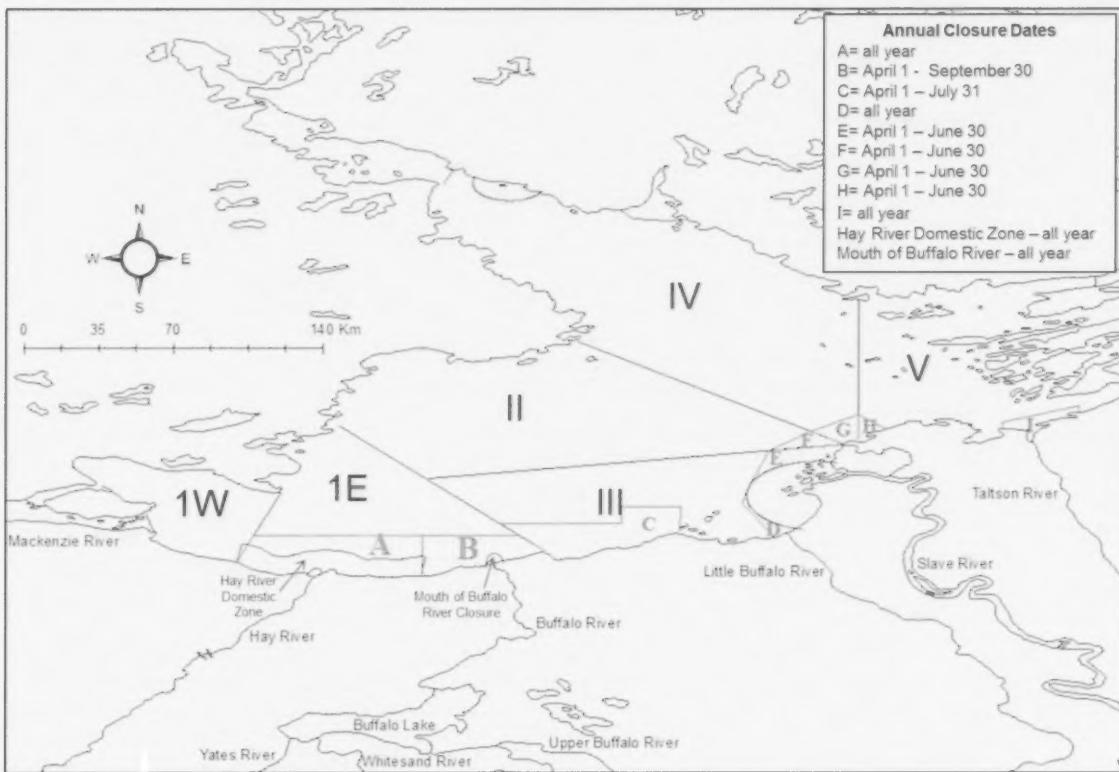


Figure 1. Administrative Areas and closure zones (A-I) in Great Slave Lake.

In late May, Inconnu congregate at the mouth of the Buffalo River and some ascend the river (VanGerwen-Toyne et al. 2013). Throughout the remainder of the summer and fall (June through September) Inconnu continue to leave GSL to migrate up Buffalo River and its tributaries to spawn (Rawson 1947, Fuller 1955, Larkin 1945 as cited in Fuller 1955, Keleher and Haight 1959, George Low, pers comm.). A concerted post-spawning out-migration occurs in mid-October (Larkin 1945 as cited in Fuller 1955, George Low, pers. comm.). A similar pattern in migratory timing has been documented for Inconnu in the nearby Slave River (Howland et al. 2000). Timing of the out-migration in both systems varies annually (Howland et al. 2000, George Low, pers. comm.).

The Buffalo River Inconnu stock was last assessed in 2010 (DFO 2013). The assessment concluded that the stock was in the critical zone of the precautionary approach framework and if the harvest of Inconnu in the west basin of GSL exceeded 10,000 kg, there was a high risk that the stock would remain in the critical zone. Implementation of closure zones intended to protect the stock were successful at reducing harvest in areas where they were applied, however the total harvest in the west basin remained above 10,000 kg in 2008-2009 (the last year of data included in the assessment).

Analysis and Response

DFO Mark-Recapture Research

From 1976 to 1978 (DFO unpubl. data) and again from 1995 to 2008 (VanGerwen-Toyne et al. 2013), a total of 2,171 Inconnu were marked with external T-bar anchor tags at the mouth of the Buffalo River or upstream at the Yates River. Recaptures were almost entirely from commercial catches and a total of 479 tags were returned to DFO. After omitting data with insufficient information (i.e., no recapture date and/or location) 420 recaptures could be used to evaluate information on Inconnu distribution. A total of 332 Inconnu (79%) were recaptured in or near Zones A or B (Figure 2), including 10 in September (Figure 3) but none in October. This illustrates the importance of Zones A and B to the Inconnu stock during the summer, but it is unclear whether the low Inconnu harvests in September and October are due to Inconnu being unavailable or a lack of fishing effort.



Figure 2. Great Slave Lake showing all recapture locations (circles) for Inconnu marked with T-bar anchor tags at the mouths of the Buffalo River and Yates River in 1976-1978 (DFO unpubl. data) and from 1995-2008 (VanGerwen-Toyne et al. 2013) (X). Numbers inside the circle indicate the number of Inconnu recaptured.



Figure 3. Great Slave Lake showing September recapture locations (circles) for Inconnu marked with T-bar anchor tags at the mouths of the Buffalo River and Yates River in 1976-1978 (DFO unpubl. data) and from 1995-2008 (VanGerwen-Toyne et al. 2013) (X). Numbers inside the circle indicate the number of Inconnu recaptured.

Commercial Logbooks

In 2010, DFO Fisheries Management initiated the mandatory use of logbooks for all commercial fishing licenses. Data presented here includes all available logbook data from June 2010 to September 2013, with the exception of those entries with insufficient information reported (i.e., no record of date or location of the net). A resulting 1,479 logbook entries (net-sets) were available, with 55 (3.7% of total) occurring in September and October. While overall fishing effort was relatively low in September and October, a total of 242 Inconnu were reported (summed from 23 of 55 net-sets, Table 1), of which 82% ($n=198$) were caught near the border of Zone A. Catch-per-unit-effort (number of Inconnu per net-set) was highest near Zone A in early September (Figure 4).

Table 1. Summary of Great Slave Lake commercial fishery logbook information for Inconnu (INCO) caught from 2010 to 2013.

Month	Total # Sets	# Sets with INCO Caught	% Sets with INCO Caught	# INCO Caught	% INCO Caught
January	24	17	2.0	35	0.3
February	30	25	3.0	56	0.4
March	32	21	2.5	38	0.3
April	35	21	2.5	60	0.5
May	7	0	0.0	0	0.0
June	439	171	20.3	1,705	13.5
July	577	360	42.7	5,621	44.7
August	273	200	23.7	4,794	38.1
September	43	21	2.5	235	1.9
October	12	2	0.2	7	0.1
November	0	0	0.0	0	0.0
December	7	6	0.7	37	0.3
Grand Total	1,479	844	100.0	12,588	100.0

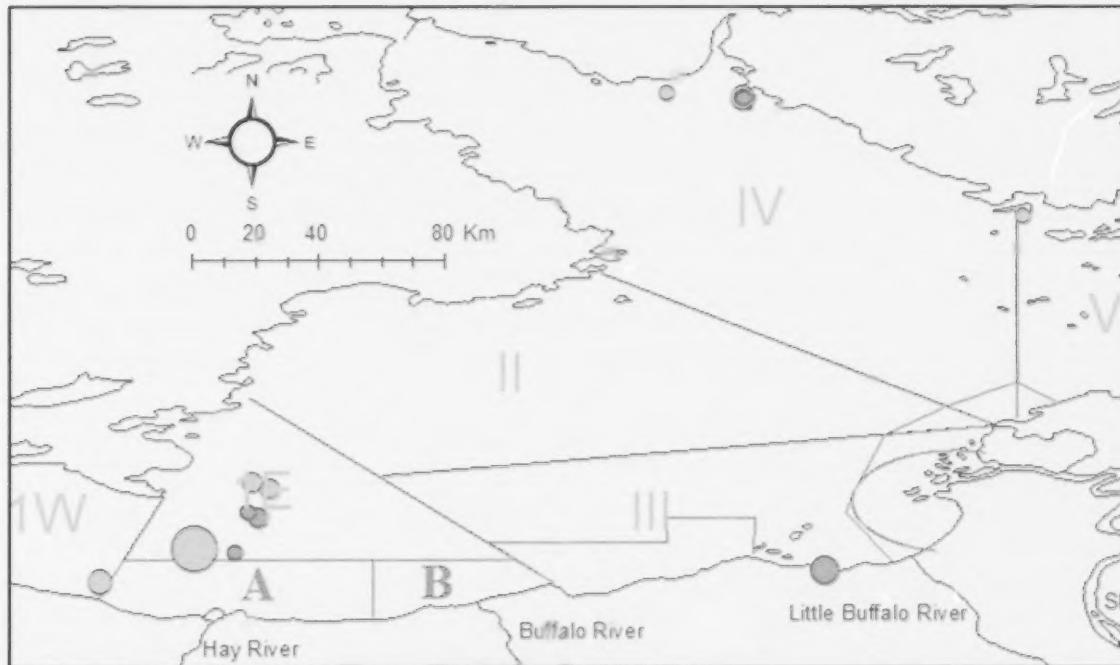


Figure 4. Great Slave Lake showing location and catch-per-unit-effort (circles) of Inconnu reported in commercial logbooks in September (blue) and October (pink) 2010-2013. Circle diameter increases with CPUE.

Commercial Harvest Trends

In 2010, a precautionary model was developed for Inconnu in GSL and the recommended maximum removal level for the entire west basin (areas 1E, 1W, and III) was 10,000 kg (round weight) (Day et al. 2013). In 2013, the Inconnu harvest from the west basin was 37,606 kg; over three times the recommended maximum removal level.

Commercial harvest of Inconnu from Area 1E alone between 2000 and 2012 was below 6,000 kg (round weight) annually, with the only exception being 2002. However, in 2013, the Inconnu harvest in Area 1E was 24,003 kg (Figure 5); 64% of the total west basin Inconnu harvest.

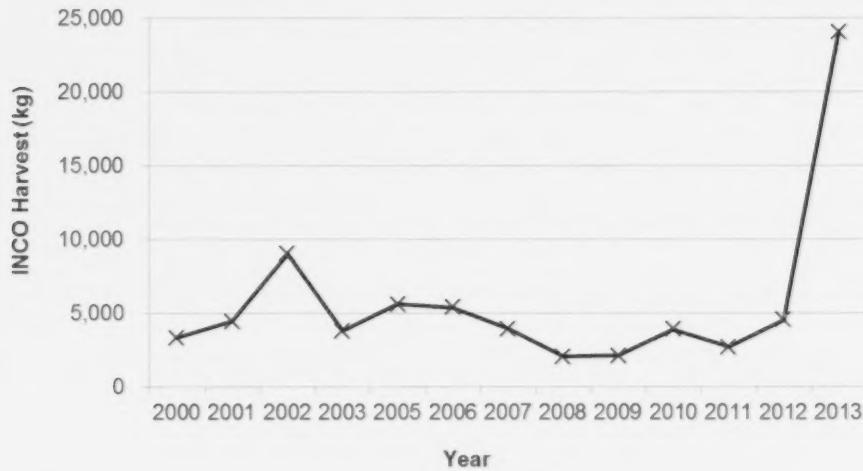


Figure 5. Annual harvest (round kilogram) of Inconnu from Area 1E of GSL from 2000 to 2013.

A review of the monthly harvest trends in Great Slave Lake Area 1E from 2000 to 2013 showed peak harvests of Inconnu during July and August, but with Inconnu also caught in June, September and to lesser extent, October. However, in 2013 the harvest in September (2,851 kg) exceeded the peak harvest in most other years (Figure 6).

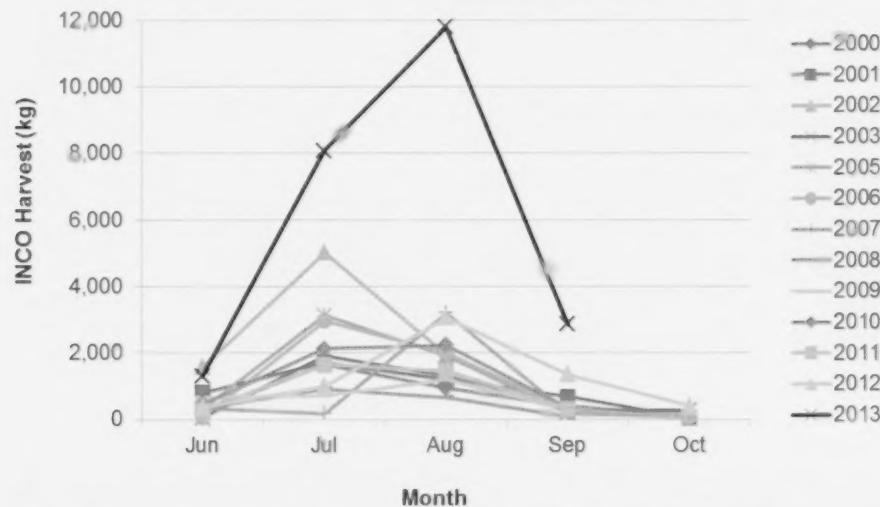


Figure 6. Monthly commercial harvest (round kilogram) of Inconnu from Area 1E of Great Slave Lake from 2000 to 2013.

From 2000 to 2012, weekly harvest data for GSL Area 1E in September and October showed Inconnu harvests of less than 200 kg (round weight) per week for most periods. However, harvests in 2000, 2012, and 2013 were notably higher at times (Figure 7). In fact, in 2013 Inconnu harvest exceeded 1,000 kg in the first week of September alone, and then decreased steadily thereafter but remained higher than that for any other week in any year, with the only exception being in 2012. This is alarming because it shows the potential to catch large numbers of Inconnu in a short period of time.

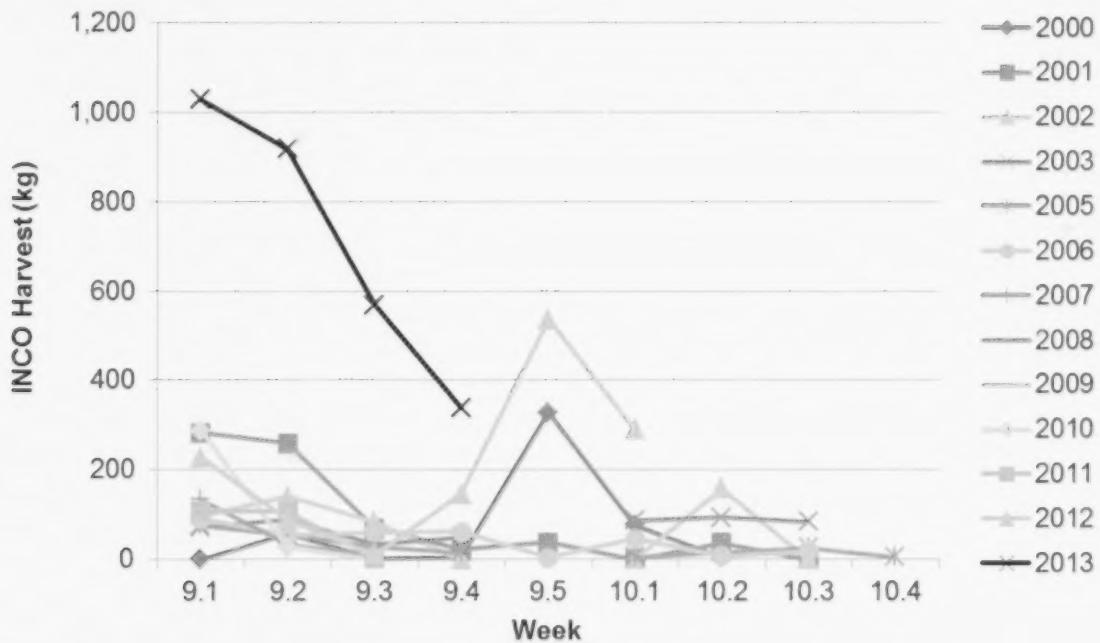


Figure 7. Weekly commercial harvest (round kilogram) of Inconnu from Area 1E of Great Slave Lake in September and October from 2000 to 2013. (Month. Week).

The percentage of Inconnu caught in relation to the total harvest (round kilogram) of Lake Whitefish and Inconnu combined [$\text{INCO}/(\text{INCO}+\text{LKWT}) \times 100$] was evaluated on a monthly and weekly (September and October only) basis from 2000 to 2013. The percentage of Inconnu in monthly catches ranged from about 0.5% in October 2006 to about 49% in June 2002 (Figure 8). Inconnu comprised approximately 10% or less of the total (Inconnu + Lake Whitefish) monthly harvest in most years but in the early 2000s the proportion of Inconnu caught in June was much higher than in later years. In 2013, an increase in the proportion of Inconnu caught monthly was apparent in July, August and September (Figure 8).

Weekly breakdown of the proportion of Inconnu caught in September and October relative to Lake Whitefish revealed peak occurrences in mid-September and mid-October in some years (Figure 9). In 2013, the proportion of Inconnu caught rose steadily throughout September. This further raises concern for the potential to catch higher than normal proportions of Inconnu, such as during spawning migrations into and out of the Buffalo River. The annual variability in the timing of the runs could increase the risk of encountering high numbers of Inconnu, which would make opening Zones A and B at pre-determined times risky.

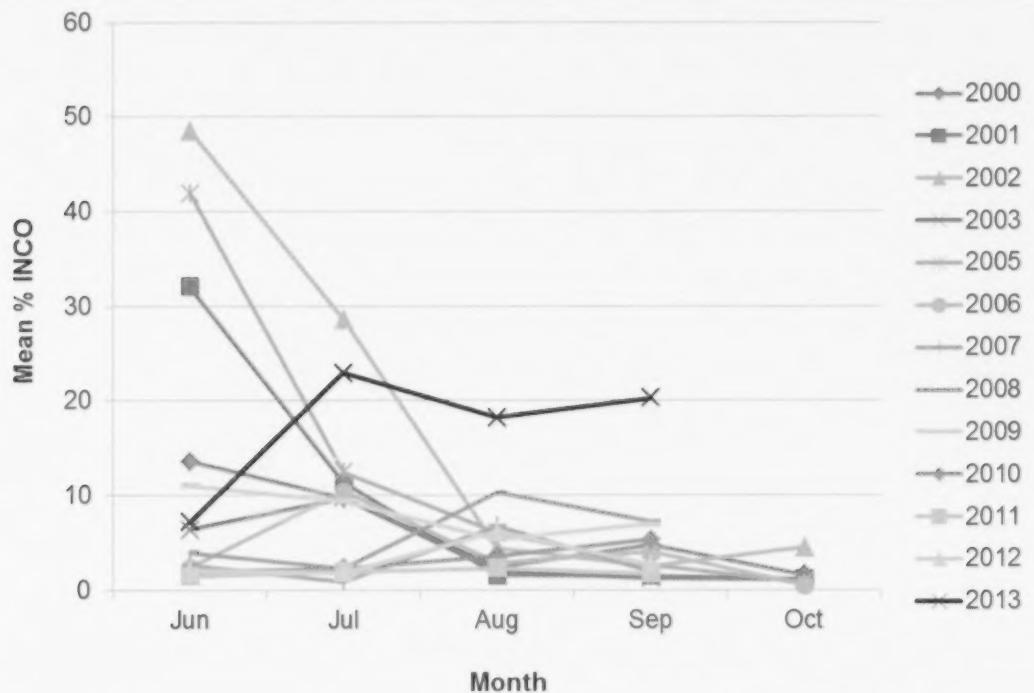


Figure 8. Mean percent Inconnu (relative to Lake Whitefish) monthly commercial harvest from Area 1E of Great Slave Lake from 2000 to 2013.

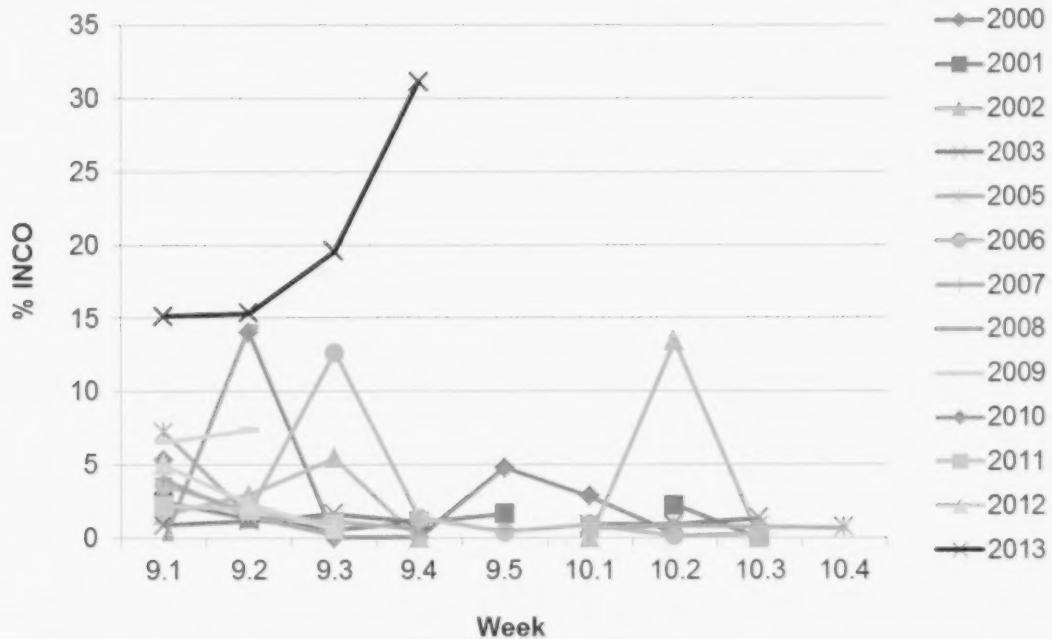


Figure 9. Percent Inconnu (relative to Lake Whitefish) weekly commercial harvest from Area 1E of Great Slave Lake in September and October from 2000 to 2013. (Month.Week)

Fishery Independent Harvest Study

All data presented thus far are dependent on the commercial fishery. To address the need for fishery-independent data on Inconnu spatial/temporal distribution in GSL, the Fishery Independent Harvest Study (FIHS) was initiated by DFO in 2010 (VanGerwen-Toyne et al. 2013). This study uses commercial mesh-size gillnets (127 mm, 5.0 inch) set in randomly selected locations from late June through mid- to late August each year, and documents the relative abundance of all species caught. When compared to the catch of Lake Whitefish, the percentage of Inconnu (# Inconnu / # Lake Whitefish*100) caught in individual nets was highest within Zones A and B (Figure 10). This further supports the importance of Zones A and B for Inconnu in the summer months, and it is likely that a high proportion of these Inconnu migrate up Buffalo River to spawn in the fall.



Figure 10. Percent of Inconnu caught compared to Lake Whitefish in Great Slave Lake during the Fishery Independent Harvest Study from late June to Mid- to late August, 2010 to 2013.

Sources of Uncertainty

All data, except the FIHS, comes from the commercial fishery. Therefore, data are limited by the fish processing plant operational season, weather conditions (starting in mid-August the winds increase making travel by boat difficult), and access (prohibited fishing in closed zones). A fall research survey in and around the Buffalo River would provide more detailed information on which an assessment could be based.

Some Inconnu from the Slave River may be represented in harvests from Area 1E. A genetic stock discrimination or additional mark-recapture studies would help resolve this uncertainty.

Conclusions

Closure Zones A and B were put in place to protect the Buffalo River Inconnu stock, and have been effective in reducing Inconnu harvest in those areas (VanGerwen-Toyne et al. 2013). Although specific studies of Inconnu utilization of Zones A and B in September and October are lacking, the data that are currently available shows a reduction, but not absence of Inconnu harvests in or near Zones A and B in September and October. Large numbers of Inconnu have been harvested in short periods of time and the proportion of Inconnu harvested relative to Lake Whitefish has also been high periodically; both of which should be considered when

contemplating the re-opening of Zones A and B. Increasing fishing effort on GSL, increasing price being paid for Inconnu by the fish processing plant, the initiation of a Lake Whitefish fall roe fishery, the extension of the fish processing plant operational season, and the greatly increased harvest of Inconnu in 2013 all increase pressure on the already depleted Buffalo River Inconnu stock. Therefore, re-opening closure Zones A and B in September and October is not recommended, and doing so would likely pose a high risk to the sustainability of the Buffalo River Inconnu stock.

Contributors

Randy Brown, U.S. Fish and Wildlife Service

Theresa Carmichael, Fisheries and Oceans Canada, Science

Kimberly Howland, Fisheries and Oceans Canada, Science

Deanna Leonard, Fisheries and Oceans Canada, Ecosystems and Fisheries Management

George Low, Dehcho First Nations

Kathleen Martin, Fisheries and Oceans Canada, Science

Ross Tallman, Fisheries and Oceans Canada, Science

Melanie Toyne, Fisheries and Oceans Canada, Science

Xinhua Zhu, Fisheries and Oceans Canada, Science

Approved by

Michelle Wheatley, Regional Director of Science, Central and Arctic Region

Rob Young, Division Manager, Arctic Aquatic Research Division

(Approved May 9, 2014)

Dedication

This report is dedicated to the memory of A. Chris Day, who spent many years as a Fisheries Research Biologist with Fisheries and Oceans Canada. Chris was dedicated to his work and had a strong belief in sustaining fish resources for the clients and their children's future. He enjoyed working with communities all around the Canadian Arctic and gained their respect for his science.

Sources of Information

Day, A.C., VanGerwen-Toyne, M., and Tallman, R.F. 2013. A risk-based decision-making framework for Buffalo River Inconnu (*Stenodus leucichthys*) that incorporates the Precautionary Approach. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/070. iv + 13 p.

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VanGerwen-Toyne, M., Day, A.C., Taptuna, F., Leonard, D., Frame, S., and Tallman, R. 2013. Information in support of Assessment of Buffalo River Inconnu, (*Stenodus leucichthys*), Great Slave Lake, Northwest Territories, 1945-2009. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/069. vii + 81 p.

Appendix

Variation Order 13/14-206-amended describing spatial and temporal areas closed to commercial fishing in Great Slave Lake in 2013. Zones that correspond to Figure 1 are added.



Fisheries and Oceans Pêches et Océans
Canada Canada

FISHERIES ACT

Central and Arctic Region Variation Order No. 13/14-206 - amended

The Regional Director General of the Department of Fisheries and Oceans for the Central and Arctic Region, pursuant to subsection 6(1) of the Fishery (General) Regulations, hereby makes the annexed Order varying the closed times for commercial fishing in certain waters of Great Slave Lake in the Northwest Territories as set out in the Schedule to this Order.

D. Burden
Regional Director General
Central and Arctic Region
Fisheries and Oceans Canada

Date

Short Title

1. This Order may be cited as the Central and Arctic Region Variation Order No. 13/14-206 - amended

ORDER VARYING THE CLOSED TIMES FOR COMMERCIAL FISHING IN CERTAIN WATERS OF GREAT SLAVE LAKE IN THE NORTHWEST TERRITORIES

Variation

2. The closed times for commercial fishing in certain waters of Great Slave Lake as set out in column IV of each item in Schedule V to the Northwest Territories Fishery Regulations is hereby varied to that set out in Column IV of that item in the Schedule attached to this Order.

Coming into Force

3. This Order shall come into force for those waters on the dates set out in column IV of this Order and remain in force until the dates set out in column IV of this Order at which time they shall revert to those set out in Schedule V of the Northwest Territories Fishery Regulations.

Variation Order
No. 13/14-206 amended

SCHEDULE
(Schedule V)

CLOSED TIMES

Item	<u>Column I</u>	<u>Column IV</u>
	Waters	Closed Times
13	That portion of Area 1(East) lying south of the 61 st parallel (excluding the Hay River Domestic Zone) and west of a straight line drawn from Fish Point 360° true, at longitude 115°20'30" to a point where it intersects the 61 st parallel.	April 1st to March 31st (Zone A)
13	That portion of Area 1 (East) lying south of the 61 st parallel and east of a straight line drawn from Fish Point 360° true, at longitude 115°20'30" to a point where it intersects the 61 st parallel.	April 1st to March 31st (Zone B)
14	That portion of Area II south and east of a straight line drawn from a point at 61°21'10"N, 113°52'50" in the north boundary of Area III to a point at 61°26'00"N 113°41'30"W intersecting the north boundary of Area II.	April 1st to June 30th (Zone C)
15	That portion of Area III lying east of a straight line drawn from a point intersecting the boundary of the Fort Resolution Domestic Fishing Zone at 61°13'21" N, 113°56'35"W, northerly to a point intersecting The southern boundary of Area II at 61°21'10"N, 113°52'50"W.	April 1st to June 30th (Zone D)
15	That portion of Area III lying east of a straight line drawn from a point on the mainland at 60°59'28"N, 113°50'42"W to a point at the eastern tip of Loutit Island at 61°07'37"N, 113°59'00", then in a straight line to a point at 61°09'36N, 113°58'00"W intersecting the Fort Resolution Domestic Fishing Zone.	April 1st to March 31st (Zone E)
15	That portion of Area III contained by straight lines drawn from the east boundary of Area 1 (East) at 61°03'00"N, 115°00'45"W to 61°03'00"N, 114°30'00"W then to 61°07'00"N, 114°30'00"W; then to 61°07'00"N, 114°15'00"W then to the shore at Pine Point at 61°00'44"N, 114°15'00"W.	April 1st to July 31st (Zone F)

Variation Order
No. 13/14-206

Variation Order
SCHEDULE
(Schedule V)
CLOSED TIMES

Item	Column I	Column IV
	Waters	Closed Times
16	That portion of Area IV lying south of a straight line drawn from the east boundary of Area II at 61°26'00"N, 113°41'30"W to a point intersecting the western boundary of Area V at 61°30'00"N, 113°30'00"W.	April 1st to June 30th (Zone G)
17	That portion of Area V lying south and west of a straight line drawn from a point at 61°30'00"N, 113°30'00"W in the eastern boundary of Area IV to a point at 61°26'41"N, 113°22'50"W on the mainland.	April 1st to June 30th (Zone H)
17	That portion of Area V enclosed by the mainland and straight lines joining the following points in the order in which they are listed: 61°26'35N, 112°54'00"W; 61°28'12"N, 112°54'00"W; 61°32'09"N, 112°34'30"W; 61°30'40"N, 112°34'30"W.	April 1 st to March 31st (Zone I)

This Report is Available from the:

Center for Science Advice (CSA)
Central and Arctic Region
Fisheries and Oceans Canada
501 University Crescent
Winnipeg, Manitoba, R3T 2N6

Telephone: 204 983-5131

E-Mail: xcna-csas-cas@dfo-mpo.gc.ca

Internet address: www.dfo-mpo.gc.ca/csas-sccs/

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